

Multiscale NTP Fuel Element Materials Simulation

Completed Technology Project (2016 - 2017)



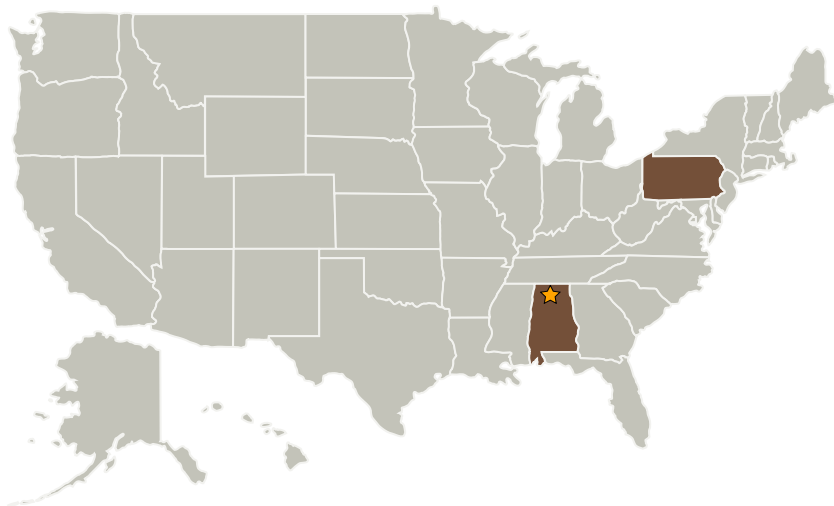
Project Introduction

Project will leverage a multiscale modeling approach pioneered for light water reactor (LWR) fuels to simulate performance in a prototypical environment. The objective is to conduct proof-of-concept simulations and illustrate the applicability of existing MARMOT (mesoscale) and BISON (macroscale) codes to CERMET Fuels in NTP conditions. Simulating the degradation of properties in CERMET fuels under the harsh conditions will require innovative computational analysis not currently available. The illustrations will be accomplished by determining the effective thermal conductivity in MARMOT and simulating heat conduction.

Anticipated Benefits

A key technology challenge for a nuclear thermal propulsion (NTP) system is the fabrication of a stable high temperature fuel. This innovative project seeks to develop modeling and simulation approaches to help in fuel element verification, since there are no test facilities in the U.S. capable of producing the required environment for effects of radiation and high-pressure, high-temperature hydrogen. Simulating the degradation of properties in CERMET fuels under the harsh operating conditions will require innovative computational analysis not currently available.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Pennsylvania

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Center Innovation Fund: MSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

John W Dankanich

Principal Investigator:

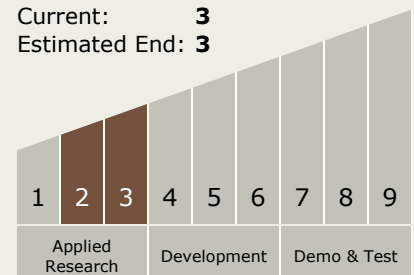
Robert R Hickman

Technology Maturity (TRL)

Start: 2

Current: 3

Estimated End: 3



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Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
 - └ TX09.4 Vehicle Systems
 - └ TX09.4.5 Modeling and Simulation for EDL

Target Destinations

Mars, Others Inside the Solar System